# NASA Activities

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## About the Cover

Shown being tested at NASA's Wallops Flight Center, Wallops Island, Va., is this single-engine research aircraft used in studies of the spin characteristics of general aviation aircraft—all planes other than commercial airliners and military aircraft. The flight tests are part of a program conducted by NASA's Langley Research Center, Hampton, Va., aimed at development of ways to prevent accident-causing stalls and spins.

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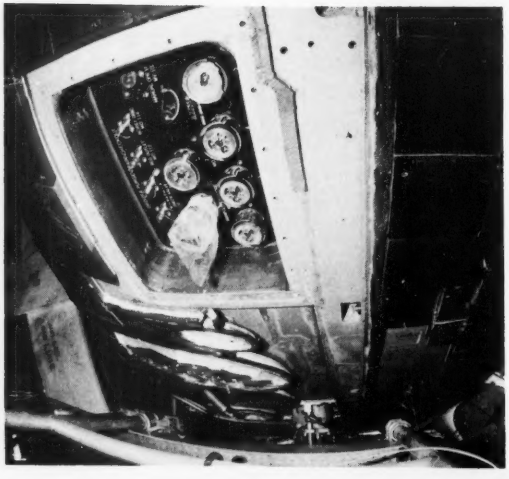
**A Spill of Consequence**—Leakage of nitrogen tetroxide oxidizer on Sept. 22 required the removal of more than 300 of Columbia's thermal protection tiles and subsequently delayed the Oct. 9 launch by about one month. The spill occurred in the forward oxidizer purge access panel shown at upper left. The December edition of *NASA Activities* will carry highlights of the second Shuttle flight, now scheduled for launch Nov. 4.

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## NASA to Give High-Flying Commuters a Lift

Advances in aviation technology at NASA's Langley Research Center, Hampton, Va., could revolutionize commuter flying in the 1990s. New aircraft designs based on NASA technology advances could be on industry drawing boards within 10 years.

These new commuter aircraft would use advanced aerodynamics, propulsion, materials and control and guidance systems being developed at Langley and at NASA's other leading aeronautical centers—Ames Research Center, Mountain View, Calif.; Dryden Flight Research Center, Edwards, Calif.; and Lewis Research Center, Cleveland.

New technology is needed to meet the dual challenge of costs and comfort. Because of their smaller passenger capacity and short-haul operation, small aircraft must be even more cost-effective than large transports. Travelers accustomed to the comfort of a large airliner want to find the same comfort in a commuter aircraft or they may shun the short hop airline in favor of surface transportation.

NASA research is aimed at the technology needed for efficient 20- to 60-passenger turboprop concepts that will be larger, faster and will travel farther than today's commuter aircraft.

NASA is contributing its expertise through wind tunnel testing, computer analysis and many other areas, and through research providing industry with technological data that industry considers too high a

Conceptual design of a 1990's commuter aircraft; it would cruise efficiently at about 500 miles per hour, taking advantage of advanced structures, propulsion, cockpit displays and control systems and an aerodynamically efficient wing.

risk for them or lacks the resources to develop—advanced configurations and innovations that offer dramatic improvements.

Some of these innovations might surprise the commuter of 1990. Instead of the usual expansive wing, researchers now believe a narrow, slender wing might provide greater lift efficiency. Greater lift is important to aircraft that spend much of their time in flight climbing or descending.

New turboprop engines that will power the commuter aircraft may be located on either side of the narrow fuselage below the vertical tail and horizontal stabilizers. There they will not interfere with the smooth flow of air over and around the wings and fuselage.

Smaller, more efficient high-speed propellers can allow the engines to be installed on the tail, contributing to a quieter ride for the traveler. The use of a smaller tail plus extensive use of advanced composite material structures will help make the commuter airplane of the future lighter and thus more fuel efficient, helping keep down the price of tickets for commuter passengers.

An on-board computer could smooth the ride of the future commuter aircraft by adjusting more rapidly the airplane's control surfaces to make the craft slice through gusts of air and air turbulence with a minimum of "bounce."

## Satellite Data Help Select Power Line Routes

Pacific Gas and Electric Company, which services northern and central California, is using NASA's Landsat satellite data to help decide the often controversial question of where to locate high voltage transmission lines.

In the prime agricultural country of California's Central Valley, the utility is concerned about the impact the transmission lines will have on agricultural production. Practically all transmission lines in the company's service areas must cross some type of farmland.

The impact of transmission lines routed through certain crops is greater than through others. The costs of growing "processing tomatoes" are extremely high, according to William Newland, a digital analyst with Technicolor Graphic Service, a contractor for NASA's Ames Research Center in Mountain View, Calif. "If Pacific Gas and Electric were to run its lines through these tomato fields, the cost of compensating farmers for acreage taken out of production is usually greater than would be the case, for instance, of crossing a grain field," Newland said. "Grapes are another crop type that the utility would like to have mapped. Because grape vines grow on wire trellises, they generally must be grounded if the trellis wires are parallel to a high voltage transmission line."

The utility is using the satellite data to help evaluate the alternative routes for a transmission line between two substations in the San Joaquin Valley.

By using data from Landsat satellites now in orbit, the major crop types that interested Pacific Gas and Electric—cotton, tomatoes, orchards, vineyards and grains—were identified in that area. A detailed land cover image has been generated using Landsat data.

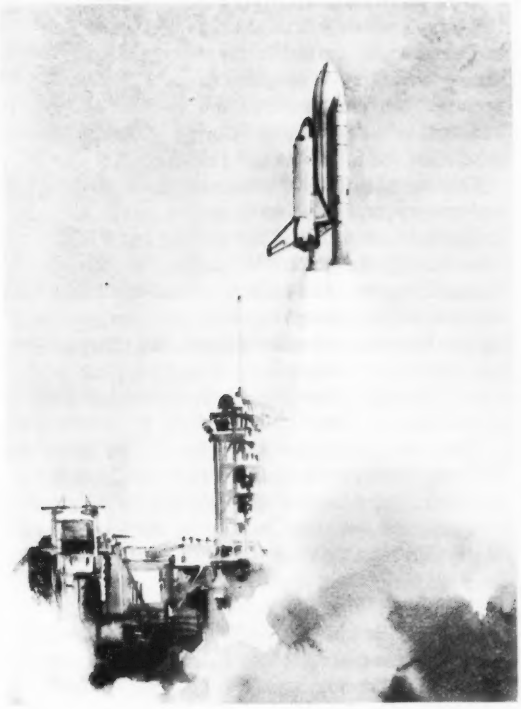
"Because the satellite covers such a wide geographic area, we were able to acquire data that covered all of our alternative corridors," said the utility's Greg Thornbury, who is directing a study of Landsat for use in transmission line siting studies. "It provides a relatively easy way to compare the alternatives within this farming area."

Each of NASA's two Landsat satellites can survey any spot on Earth every 18 days. A multispectral scanner on each satellite records differences in Sun reflectance from Earth surface features. The scanner takes four readings (four spectral bands) for each 1.1 acre area on the ground of reflected visible and invisible (infrared) light images. The intensity levels of this light are then converted to film images and computer compatible tapes at stations on Earth.

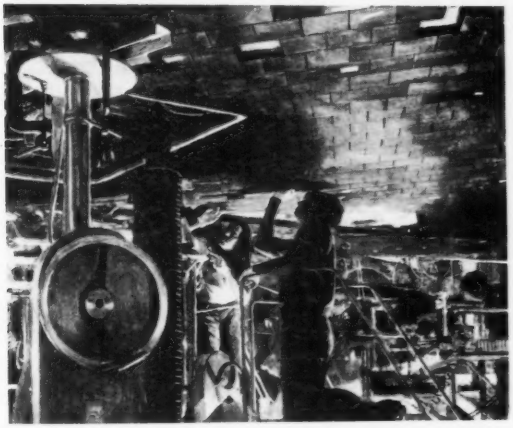
Landsat data from May, July and August 1979 were used. Supplied with ground data collected by California's Department of Water Resources and Pacific Gas and Electric from selected areas of the Fresno region, the analysts studied one-mile by one-mile segments containing the crops PG & E wanted to identify to determine signatures for these cover types.

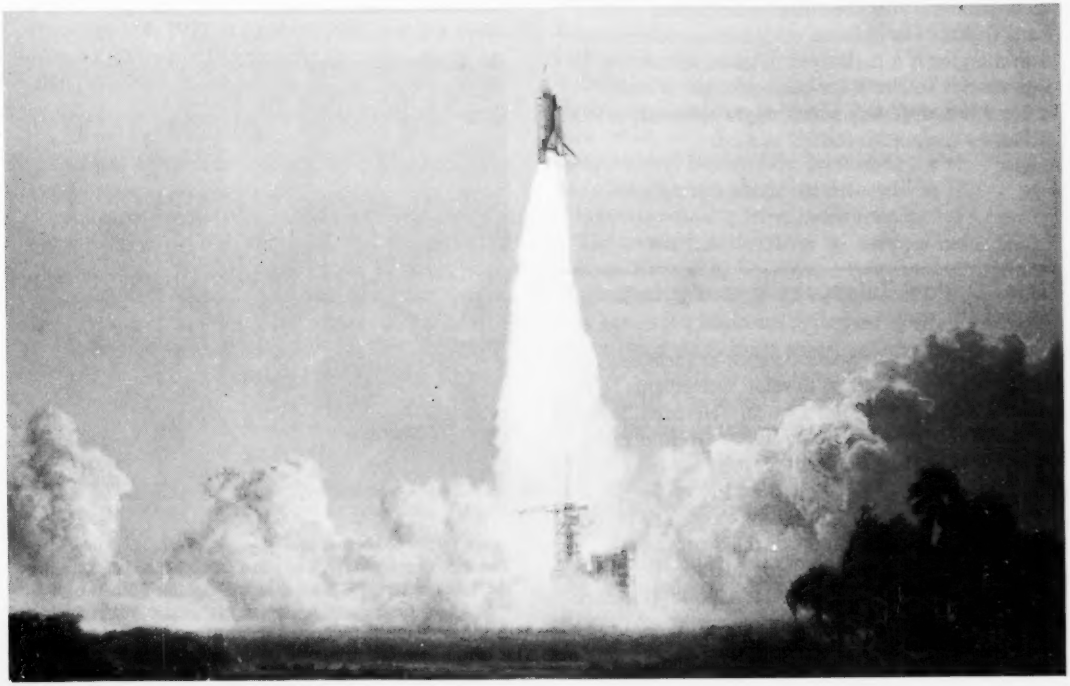
A signature is determined by matching the spectral reflectance measured by the Landsat instrument with known crops identified by the ground track surveys. After these small areas have been matched, the satellite information can be used alone to identify the crops in the total area of interest.

Pacific Gas and Electric plans to go before the California Public Utility Commission with the corridor location proposal. Dave Sinnott of NASA's Ames Research Center was the government interface for the project.



**Latest NASA Art**—(top left) **Blast Off,** watercolor by Arthur Shilstone, showing the Columbia moments after ignition on April 12, 1981. (top right) **Tile Team,** oil painting by Morton Kunstler, orbiter processing facility, Kennedy Space Center, Fla. (bottom ) **1:07:22 and Counting,** watercolor by Arthur Shilstone, showing a view from the press site of the Columbia prior to its dawn launching in April.





## Preparations Underway for Third Shuttle Flight

While the second flight of the Space Shuttle, STS-2, is readied for its November launch at the Kennedy Space Center, Fla., preparations for the third flight, STS-3, scheduled for launch Jan. 18, 1982, are underway at NASA's Marshall Space Flight Center, Huntsville, Ala.

The release mechanism for the plasma diagnostics package, which will fly on STS-3, has been shipped from Marshall, where it was developed, to Goddard Space Flight Center, Greenbelt, Md. The package, built for Marshall under contract by the University of Iowa, is part of the OSS-1 payload which will fly on STS-3. The OSS-1 payload, sponsored by NASA's Office of Space Science, is managed by Goddard. It will be the first Shuttle hardware item to be picked up by the orbiter's robotic arm, the remote manipulator system. The experiment package will be unlatched from the release mechanism, moved about the cargo bay to investigate plasma and electromagnetic emissions around the orbiter, and then replaced in the mechanism for return from orbit.

Another release mechanism, also built by Marshall, will fly aboard both STS-2 and STS-3 to hold down the Marshall-developed induced environment contamination monitor to be carried aboard both flights. The induced environment contamination monitor is a desk-sized detector containing 10 instruments to check for contaminants in and around the cargo bay which might adversely affect delicate experiments carried aboard.

## Solar Optical Telescope Investigators Selected

NASA's Office of Space Science has selected two scientific investigators to develop instruments to fly aboard the planned Solar Optical Telescope. Selected as instrument investigators were Dr. Harold Zirin, California Institute of Technology, Pasadena, Calif., and Dr. Alan M. Title, Lockheed Palo Alto Research Laboratory, Palo Alto, Calif. The current timetable for the first flight of this instrument, which is expected to expand considerably on the unsurpassed results of the Skylab Apollo Telescope Mount, shows initial launch in the spring of 1987 with reflights scheduled thereafter.

Zirin proposes developing a photometric filtergraph which will be able to observe the Sun through various optical filters in the near infrared, visible and ultraviolet regions of the spectrum. The proposed instrument will be able to make several hundreds of images on film during the one-week mission of the Solar Optical Telescope.

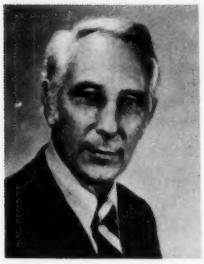
Title's proposal is for a coordinated filtergraph and spectrograph which will include a tunable visible-light and optical filter system and a high resolution spectrograph with motion compensation. The spectrograph will operate in both the visible and ultraviolet spectral regions. Both the filtergraph and the spectrograph will record data using charge-coupled device imaging systems and relay the information directly to the ground for examination by scientists.

These two instrument assemblies will be located at the focal point of a 1.25-meter (4-foot) diameter telescope. The telescope assembly will be mounted on a pointing system located within the Space Shuttle payload bay. The Solar Optical Telescope will be designed for a variety of solar physics investigations on several Spacelab flights.

Program scientist for the Solar Optical Telescope is Dr. Eric Chipman, NASA Headquarters; program manager for the telescope is Ronald Felice, also of NASA Headquarters.

**Space Telescope Ground Breaking**—Johns Hopkins University President Steven Muller (left) and Riccardo Giacconi, Director of the Space Telescope Science Institute, examine a model of NASA's telescope during a ceremony celebrating the beginning of construction of the facility scheduled to be completed in 1983 and located on the University's Homewood campus.

## Edwin C. Kilgore Retires



Edwin C. Kilgore, NASA Headquarters' Associate Administrator for Management Operations, retired Oct. 2. Appointed to this position in March 1980, Kilgore has 37 years NASA service.

He is the senior agency official responsible for providing an integrated focus for agency-wide institutional management and for overall management of resources in support of programs at all NASA installations. Ann P. Bradley, Deputy Associate Administrator for Management Operations will serve as Acting Associate Administrator.

Kilgore has received many awards and decorations—the Presidential Meritorious Award in 1980, the Roger Jones Award for Executive Leadership from American University in 1978, and NASA's Distinguished Service and Outstanding Leadership Medals. He is also a winner of the Honorary Group Achievement Award of the Rocket Motor Review Board for his work in helping to achieve a record of 97 consecutive firing successes for solid-fueled rocket motors managed by NASA's Langley Research Center, Hampton, Va.

Born Jan. 24, 1923 at Coeburn, Va., he is a 1944 graduate of Virginia Polytechnic Institute, where he received a bachelor's degree in mechanical engineering.

He joined Langley Research Center after graduation and was assigned to the engineering division as a developmental design engineer of specialized research equipment. He was appointed technical assistant of the Machine Design Branch in 1954, and assistant chief of the Engineering Service Division in 1960. Designated chief of Flight Vehicles and System Division in May 1968, Kilgore shared responsibility for setting policies to operate and manage centralized engineering support to all Langley research activities.

Kilgore played an important role at Langley in the conceptual planning, design and problem-solving for such space projects as Lunar Orbiter, the S-55 Micrometeoroid Satellite, San Marco, Scout, Project Fire and Echos 1 and 2.

Kilgore came to NASA Headquarters in 1970. During the next five years, he served in several management positions, including Deputy Associate Administrator (Management) in the Office of Aeronautics and Space Technology, and as Acting Associate Administrator for the office.

In 1974, he was named Deputy Associate Administrator for Center Operations, a newly-formed office responsible for all NASA field center operations.

In 1975, he returned to Langley, where he was appointed Director of Management Operations. There he was responsible for major administrative functions and oversaw center activities in personnel, financial management, procurement, management support, business data systems programs and resources, scientific and technical information, occupational health services and technology utilization.

In August 1979, he returned to NASA Headquarters as Acting Associate Administrator for Management Operations until March 1980, when he was appointed to fill this position.

## Shuttle Work Station Tested

The concept of a possible assembly line in space that would allow astronauts to construct large platforms or antennas in Earth orbit from the Space Shuttle was tested under simulated weightless conditions at NASA's Marshall Space Flight Center, Huntsville, Ala.

Tests were conducted in the center's Neutral Buoyancy Simulator, a huge 1.3-million-gallon water tank which allows an approximation of zero-gravity environment. Researchers performed the tests to gain basic information about the productivity of astronauts building large space systems.

The concept, under study by Langley Research Center, Hampton, Va., uses a mobile work station to position a pair of pressure-suited astronauts so they can move horizontally and vertically within a prescribed area to build space systems that are too large or complex to fold up and transport aboard the Shuttle. The mobile work station is designed to be located inside the Shuttle orbiter's payload bay or to be a free flyer, operating near the orbiter.

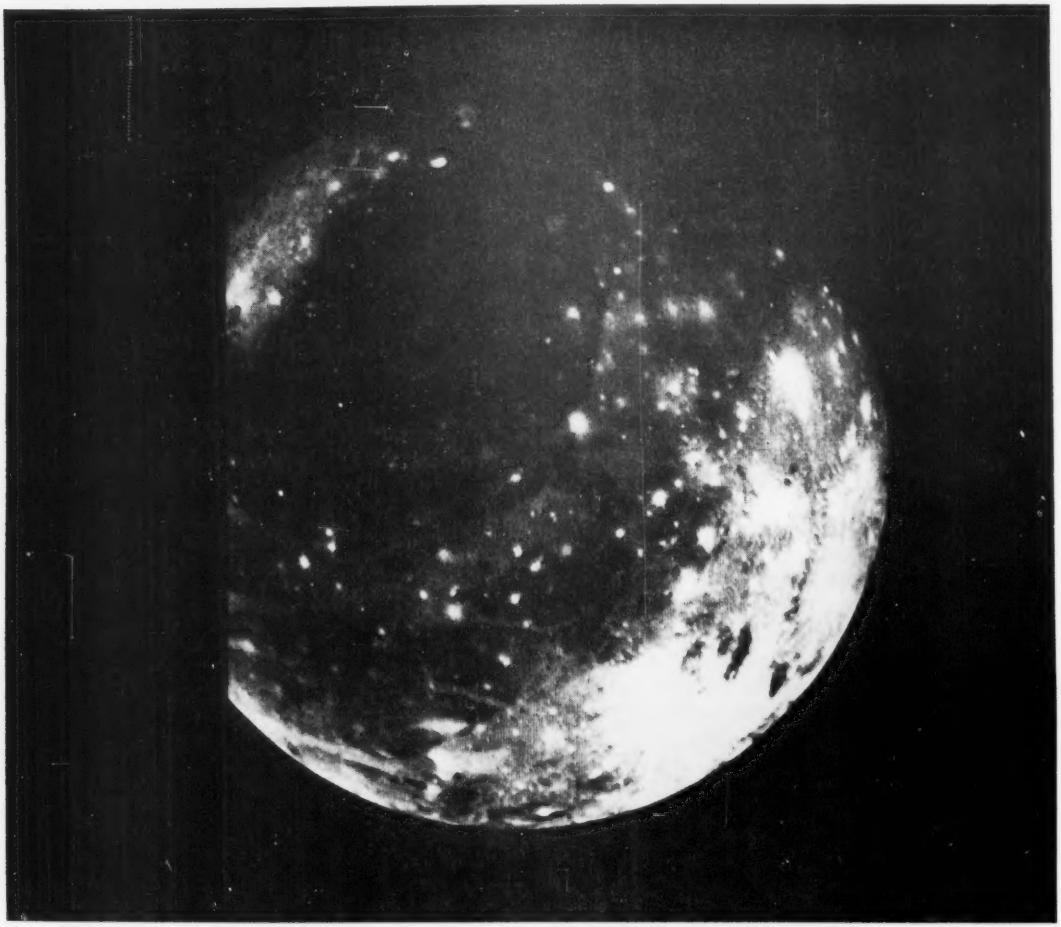
A large-scale experimental model of the mobile work station is being tested at Langley. The ground test model will enable researchers to uncover difficulties that might be encountered in space and identify assembly aids to improve astronaut productivity.

## Voyager Photos Offer Unexpected Discoveries about Jupiter's Moons

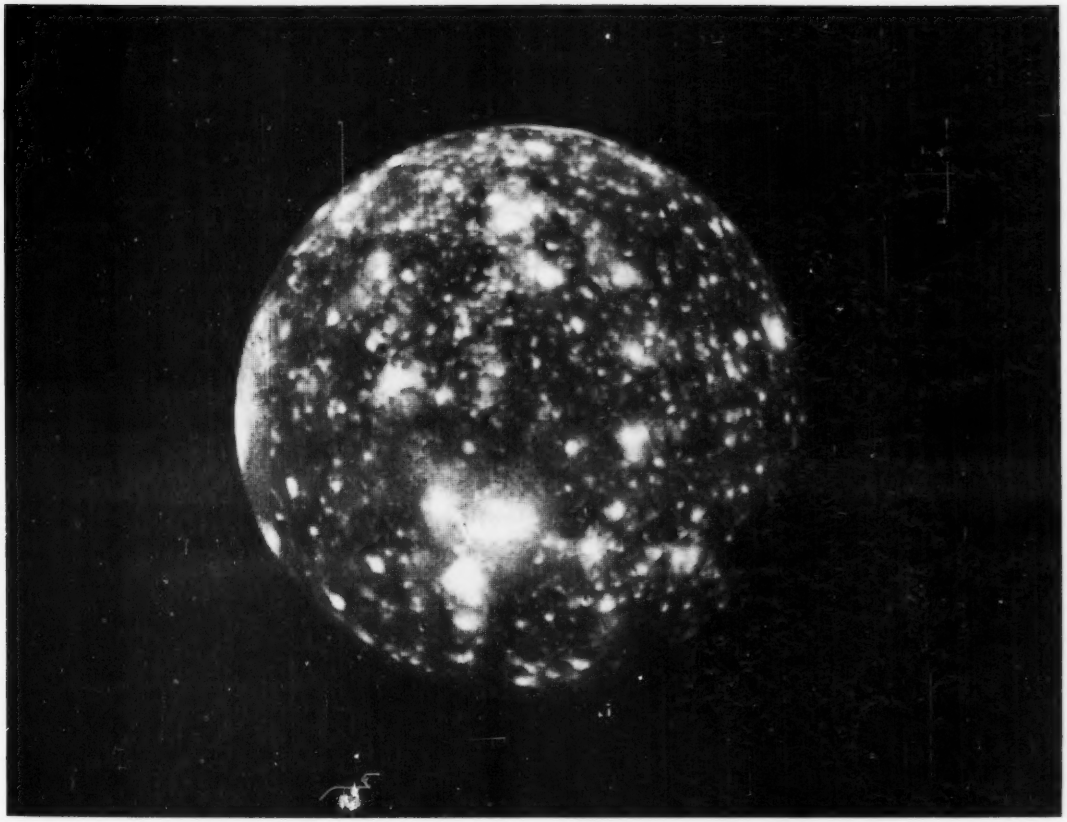
Unexpected discoveries about Ganymede and Callisto, Jupiter's largest moons, have triggered debate over their origins and development. Scientists believed the sibling satellites would look alike, equally devoid of atmosphere or activity except for craters left from meteorite bombardment.

However, Voyagers 1 and 2 in their 1979 flybys of Jupiter have unveiled a surprisingly different, bimodal face on Ganymede, apparently the result of internal heating, which contrasts with Callisto's uniformly cratered surface. How did Ganymede experience this heating which reworked its surface, when Callisto did not?

"If we could find the answer to this question," says Patrick Cassen, a researcher at NASA's Ames Research Center, Mountain View, Calif., "it would tell us a lot about planetary formation and evolution in general. Ganymede and Callisto have a relationship much like that of Earth and Venus, for example. Both began as similar bodies but evolved into planets with different characteristics because of very subtle differences in them or their environments." Before the Voyagers' trips to Jupiter, early studies had established that Ganymede and Callisto were



Voyager 2 photo of Ganymede, the largest Galilean satelliite, taken on July 7, 1979 from a range of 1.2 million kilometers (746,000 miles).



Voyager 2 photo of Jovian satellite Callisto, also taken July 7, 1979, from a range of 2.3 million kilometers (1.4 million miles).

composed primarily of water and rock particles, frozen because surrounding temperatures remain below the melting point of ice.

Ganymede, though Jupiter's largest satellite—about 1 ½ times the size of our Moon—is only slightly larger than Callisto and occupies an adjacent orbit around Jupiter. Thus, Ganymede was expected to look like Callisto.

Voyager pictures show that Callisto is, as predicted, a frozen, pock-marked sphere without atmosphere or evidence of internal activity. In fact, scientists have found that Callisto holds more craters than any other body in our solar system. The craters are remnants from four billion years ago, when meteors showered through our forming solar system.

But in Voyager images, this ancient terrain, found on both Ganymede and Callisto, appears dark and dull, not bright. And parts of Ganymede's surface are light and covered with grooves which seem to overlap the older terrain. These finds have sparked debate among scientists.

The darkness of this cratered ground seems to come from contamination of the ice. Some scientists believe a uniform mixture of rock and ice frozen together, with rock particles in the ice, is responsible for the darkness. Others advocate a two-layer model, with an ice shell encasing a rocky center with the darkened surface caused by collected dust and cosmic particles.

And the brighter terrain, according to Cassen, "is probably a younger surface. This second surface was most likely caused by internal heating which might have melted or weakened the ice, producing flow, grooves and overlap as we see."

Three likely sources of this extra heating which changed Ganymede's face, according to Ames scientists Cassen and Ray Reynolds and Stanton Peale of the University of California at Santa Barbara, are

formational heat, radioactive energy and tidal dissipation. These researchers believe the radioactive effect was the most important heating factor, despite controversy.

Formational heat is the heat which all planetary bodies release as they form. If Ganymede formed faster it would have retained more heat energy, making it warmer.

Ganymede also experiences stronger radioactive heating as it contains more rock. (All rock radiates energy from radioactive decay. More rock will therefore mean more radioactive heating.)

In fact, Ganymede's core, if it exists, is estimated to be about 50 percent larger than Callisto's. This difference could have provided up to 400 million years' worth of additional heat flow in Ganymede.

Tidal heating could also have prolonged the initial hot period on Ganymede. Tidal heating is the energy created by the squash and stretch satellites experience because they do not orbit in perfect circles. Thus, when closer to Jupiter, Ganymede feels a greater pull and responds by becoming slightly egg-shaped. Then, when farther from the planet, the satellite flexes back to a more nearly spherical shape. This flexing generates heat in the satellite.

Cassen, Reynolds and Peale's calculations show that tidal dissipation would have been at least 100 times less on Callisto than on Ganymede because Ganymede is closer to Jupiter.

Scientists hope that the Galileo Orbiter, scheduled to rendezvous with Jupiter in 1989, will pass close enough to these two satellites to provide information that will further improve these theories.

## Gillam Named Special Assistant to NASA Administrator

Isaac T. Gillam IV, Director of NASA's Dryden Flight Research Center in Edwards, Calif., has been named Special Assistant to the Administrator of NASA. Gillam will be detailed to the White House Office of Science and Technology where he will participate in a Space Policy Review.

Gillam began his 18-year career at NASA Headquarters in 1963 as a Resources Management Specialist. In 1966 he was appointed Assistant Program Manager for the Delta launch vehicle and in 1968 became Program Manager. He was involved with Delta and Scout launch vehicles and numerous international cooperative and reimbursable projects while Program Manager of Small Launch Vehicles and International Projects for NASA in 1973.

During the Space Shuttle Approach and Landing Tests in 1977, Gillam was Director of Shuttle Operations at Dryden. He was named Director of Dryden on June 7, 1978, after serving as Deputy Director.

Gillam received NASA's highest award, the Distinguished Service Medal, for his work on the NASA launch vehicle program and a number of other awards.

## Lilly Retires from NASA

William E. Lilly, NASA's first Comptroller, retired in early October after more than 37 years of federal service, the last 21 with NASA.

Lilly joined NASA in February 1960 as Chief, Plans and Analysis, Office of Launch Vehicles, and in 1961 became Director of Program Control for the Office of Manned Space Flight. He became Assistant Administrator for Administration in March 1967 and was named as Associate Administrator/Comptroller in January 1973. Before joining NASA, Lilly was Assistant to the Director, Plans and Programs, Special Projects Office, Department of the Navy from 1956 to 1960, where he was a key contributor to the Polaris Weapons Systems development.

He was deputy budget officer at the National Bureau of Standards from 1954 to 1956; head of Estimate and Analysis Section at the Navy Bureau of Ordnance from 1952 to 1954; and a budget and program analyst with the Navy Ordnance Test Station, Calif., from 1950 to 1952.

Born in Liberty, Texas, Lilly served in the U.S. Navy during World War II and graduated with highest honors from the University of California at Berkeley, where he was elected to Phi Beta Kappa and Pi Sigma Alpha. Among many honors, Lilly is the recipient of two NASA Distinguished Service Medals, two NASA Exceptional Service Medals and the Career Service Award of the National Civil Service League. In 1980, he was one of the first federal executives to receive the Presidential Rank of Distinguished Executive.

## Fuel-Saving Winglets Flight Tested

Winglets—NASA-developed air foils designed to increase the fuel efficiency of airplanes—are being test-flown aboard a wide-body commercial aircraft. Winglets are a part of NASA's Aircraft Energy Efficiency Program, aimed at developing advanced technologies that could reduce fuel consumption by 50 percent in new air transports.

Aeronautical research is the focus at four NASA centers: Langley Research Center, Hampton, Va.; Ames Research Center, Mountain View, Calif.; Dryden Flight Research Center, Edwards, Calif., and Lewis Research Center, Cleveland.

Winglets are small, wing-like structures attached to the tips of an airplane wing, almost perpendicular to the wing surface. They cut fuel-consuming drag in aircraft by lessening the effect of wingtip vortices, the turbulent swirls of air that form at the wingtips of all aircraft in flight.

The test plane, a DC-10 Series 10 jetliner leased from Continental Airlines, has two winglets attached to each wingtip: a 3.2 meter (10.5-foot) winglet is atop the wing, pointing upward; a 0.8 m (2.5-ft.) one is attached beneath the wing and pointing downward.

The test program is being conducted by the McDonnell Douglas Corp. under a contract with Langley Research Center. Early flight tests have been made at Dryden Flight Research Center; later tests are being flown at a Douglas development facility at Yuma, Ariz.

Based on wind tunnel tests, a fuel reduction of about three percent is expected with the DC-10 winglets. That amounts to an annual savings per plane of about 250,000 gallons of fuel, now priced at more than one dollar a gallon. A successful test program could lead to the use of winglets on all DC-10 commercial aircraft.

The winglet concept was developed by Dr. Richard T. Whitcomb, recently retired Langley aeronautical designer. They have been tested on several kinds of small aircraft, but never before on a plane as large as the DC-10. Winglets are already in commercial use on the Gates Learjet 55 (called the "Longhorn") and the Grumman Gulfstream III.

Winglets reduce lift-induced drag, which accounts for about 40 percent of the total drag on an aircraft at cruising speed and altitude. Lift-induced drag is produced by the same aerodynamic forces that provide the lift that keeps an airplane in the air.

Instead of extending an airplane's wingspan, which adds fuel-consuming weight, winglets can reduce drag with much less weight penalty. Lift-induced drag is primarily caused by wingtip vortices. Winglets reduce the effect of a vortex by lessening its strength and moving it outward and upward toward the tip of the winglet.

Whitcomb was a consultant to McDonnell Douglas on the design and placement of the DC-10 winglets. Preliminary wind tunnel tests were conducted at Langley, Ames Research Center, and at Douglas, beginning at Langley in 1976.

Test plane equipped with winglets—small, wing-like structures attached to the tips of the wings, almost perpendicular to the wing surface. Winglets lessen fuel-consuming drag in aircraft.

## Aerial Photos Spot Clogged Drainage Lines in Irrigated Croplands

Researchers are using color-infrared photography to help California Imperial Valley farmers spot clogged drainage lines in irrigated croplands. The techniques being tested should be useful in other irrigated areas such as Europe where farmers rely on similar drainage lines.

Irrigated farmlands can become less productive due to salts deposited by evaporated water. In the Imperial Valley, an intricate system of drainage lines, located 1.8 meters (6 feet) underground, is used to flush out saline water and control the water table below the root zone. These drainage lines can get clogged because of chemical, bacterial or physical activity, preventing the removal of the saline water.

Researchers from the federal Department of Agriculture (USDA) and NASA's Ames Research Center in Mountain View, Calif., are using aerial color-infrared photography to learn how to pinpoint these clogged lines before the crops are damaged.

If a clogged drain is discovered before there is any damage to the crops, the drain can be unclogged by using high pressure jet cleaning devices and the crop saved.

NASA aircraft photographed the same drainage lines four times over bare soil last November, five times last June, and once in August, when the crop had reached maximum growth. By comparing the photographs over these time periods, the scientists will be able to detect a pattern of parallel streaks, indicating areas that are drying. A clogged drain will cause a break in this pattern.

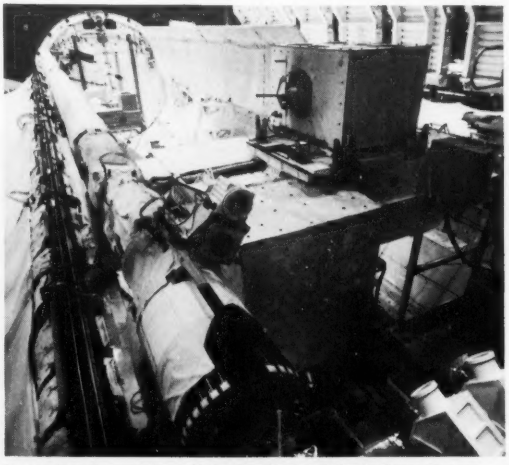
According to project scientists, the goals of the program are to determine how often to survey, what time of day to survey, how high to fly the plane, what type of sensors to use, and whether to survey when there is bare soil or a crop canopy. Preliminary findings indicate that "the higher we fly the better," said John Millard from NASA-Ames Research Center. Infrared photography appears to be the best sensing method. The remaining questions should be answered over the next six months as the data is analyzed.

Once these questions are answered, NASA and the USDA hope to turn the work over to private aerial photography firms that can be commissioned by local farming organizations. Project scientists from USDA are Luther Grass from Brawley, Calif., and Paul Nixon from Weslaco, Texas.

## Booster Parachutes Assessed for Reuse on Future Flights

With today's national interest in economizing and reducing costs, engineers at NASA's Marshall Space Flight Center, Huntsville, Ala., have assessed solid rocket booster parachutes from the first Space Shuttle mission for reuse in later missions. Initial evaluation of the center's Materials and Processes Laboratory indicates they are in "excellent" condition with overall damage consisting of orange and tar-like stains, and scorched and burned areas and torn material.

The material deposit causing the orange stain has been identified as iron oxide from the water used to wash the parachutes. The tar-like stains are still being analyzed, but are believed to have been caused by burning insulation exhausting from the nozzle. The scorched and burned areas were caused by hot exhaust from the nozzle and will be replaced, as will the torn material, except the frayed drogue radial extensions which tests have determined are well within design limits. The parachutes presently are being reworked and repaired in preparation for reuse on the fourth Space Shuttle mission and reuse is expected to meet or exceed the original 10 flight mission usage.



**Space-Age Arm** – View of the the Remote Manipulator System for Shuttle payloads shown mounted in the payload bay of the Columbia. The socket-like end effector of the arm and the CCTV monitor used to guide the arm are both shown at lower left. At the upper right is the grapple fixture on its square mount that will provide a target for the test grapple-interface operation to be conducted in orbit during the second flight of Columbia.

## Did You Know?

**Dr. Alan M. Lovelace,** NASA Deputy Administrator from June 1976 until January 1981, and Acting Administrator from January to July 1981, received a NASA Distinguished Service Medal in September. Lovelace is now Corporate Vice President—Science and Engineering, General Dynamics Corp., St. Louis, Mo. Presenting the award was NASA Administrator James M. Beggs.

NASA's film **Space Shuttle—Mission To The Future** has been selected to represent the United States at the 12th Festival of Scientific and Technical Films, Belgrade, Yugoslavia, February 1982. Other international film festivals in which this film represents the United States are: 2nd Adventure Film Festival, Cortina, Italy; The World Aerospace Festival, Amsterdam, Netherlands; 9th Festival of Scientific-Technical Films, Katowice, Poland; 10 Thessaloniki International Film Festival, Thessaloniki, Greece; 18th International Festival of Science Fiction Films, Trieste, Italy; and the Cine Festival, Washington D. C. The Interdepartmental Committee on Visual and Auditory Materials for Distribution Abroad, established by the Secretary of State, represents 17 main U.S. Government agencies and 10 sub-agencies and is responsible for the entry of U.S. Government films in international festivals.

**Roland H. Chase,** chief engineer of NASA Headquarters Spacelab Flight Division, Office of Space Science, retired from NASA on Sept. 29 after 25 years of service. He started his professional career at the Wright Patterson Air Force Base as an officer responsible for the development of advanced weapons systems. He joined NASA as a solar physicist from Westinghouse in April 1961, assigned to Goddard. In May 1962, he transferred to NASA Headquarters to manage the Laser Communication and Tracking Research and Development program.

**NASA's Lewis Research Center,** Cleveland, participated in "Kingston '81—Exhibition and Symposium on Renewable Energy Applications for the Caribbean" on July 28-30 in Kingston, Jamaica. NASA was represented by Donald Bogart of the Stand-Alone Photovoltaic Project Office who presented a paper at the symposium on photovoltaic applications for developing countries. The Langley exhibit was well received.

The **first international meeting** of investigators for the **Long Duration Exposure Facility**—a major Space Shuttle payload—was held at NASA's Langley Research Center, Hampton, Va., Sept. 15-17. Approximately 100 representatives of universities, private companies, government agencies and eight foreign countries attended the meeting. Together for the first time were most of the investigators who are working on 47 separate scientific and technical experiments that will be placed in low Earth orbit for passive exposure to the space environment for about one year.

Scheduled for launch in January 1984, the Long Duration Exposure Facility is the largest payload now planned to be deployed in Earth orbit and retrieved by the Shuttle orbiter; experiments include such diverse investigations as the effect of space radiation on biological specimens, obtaining information about the formation of the solar system, and development of advanced materials, coatings and solar cells for space use.

**William F. Cuddihy,** chief of the Plant Engineering Div., Langley Research Center, retired Aug. 29. He had been responsible for construction and maintenance of facilities and energy management at Langley since March 1980. A specialist in electronics, space communications, computers and systems engineering, Cuddihy has written or coauthored more than 20 publications and holds patents on a reentry communications system and a plasma arc device. He has received many NASA awards, including a NASA Exceptional Service Medal.

Two NASA Langley Research Center employees have been selected for temporary assignment in **NASA's Critical Assignment Development Program. Donald L. Lansing,** head of the Unsteady Aerodynamics Branch, Loads and Aeroelasticity Div., will be program manager in the Propulsion Office, Research and Technology Div., at NASA Headquarters. **Thomas E. Pinelli,** assistant chief, Research Information and Applications Div., is filling the temporary vacancy of chief, Technical Information Div., at NASA's Ames Research Center. Critical Assignment Development Program is designed to meet a critical program need at NASA Headquarters or a field center and to develop employees who have special skills essential to a NASA program. The program is a temporary assignment for up to one year, augmented by agency, interagency and Congressional seminars, briefings, meetings and hearings.

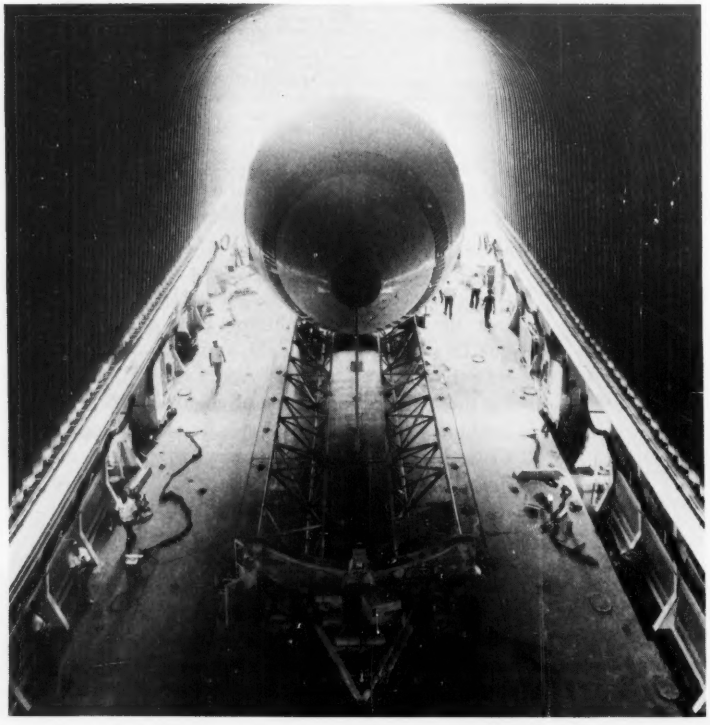
## Contractor News

**Vought Corp.**, Dallas, Texas, aerospace subsidiary of LTV Corp., Dallas, has been awarded a contract by NASA's Langley Research Center, Hampton, Va., for systems management of the Scout launch vehicle. The contract, valued at just over $39 million is a three-year continuation of a similar contract awarded in 1976 and modified in 1979. The new contract begins Nov. 1, 1981. Under the terms of the contract, Vought will provide systems engineering, reliability and quality assurance programs, vehicle processing and launch and logistics support services.

NASA's Johnson Space Center, Houston, Texas, has selected **Barrios Technology, Inc.**, Houston, for negotiations leading to a contract for instrument calibration and repair at the center. Beginning Dec. 1, 1981, the proposed small business set-aside cost-plus-award-fee contract will be valued at approximately $3 million for its first two-year period. Extensions for a total of five years will be optional.

**IBM Corp.**, Federal Systems Div., Houston, has been selected by NASA's Johnson Space Center, Houston, for negotiations leading to award of a firm fixed-price contract for a computer system to be used in the center's software production facility. The proposed contract will cover automatic data processing hardware, systems integration, software program products and maintenance over a five-year period. Extensions for systems maintenance beyond the initial five years will be provided by the contract, expected to be valued at approximately $16 million.

**Systems Development Corp.**, McLean, Va., has been selected by NASA Headquarters, Washington, D.C., for negotiation of contract for operation of the Slidell Computer Complex in Slidell, La. The contract is for an initial period of one year, beginning Nov. 1, 1981, and includes two one-year priced options and two one-year unpriced extension periods. The approximate cost of the work is $7 million for the first year and a total of $21 million for the first three years. The Slidell complex, an activity of the Marshall Space Flight Center in Huntsville, Ala., is primarily responsible for fulfilling the computational requirements of NASA and certain NASA contractor-operated plants.



**Shuttle Tank Shipped**—Like some huge alien egg bathed in an other-worldly glow, the forward segment of a Space Shuttle external tank is loaded aboard the NASA barge "Orion" at NASA's Marshall Space Flight Center, Huntsville, Ala. After spending three years undergoing testing at Marshall, the liquid oxygen tank is making the return trip down river to Marshall's Michoud Assembly Facility in New Orleans, where all Shuttle tanks are built.

## Expendable Launches for 1981

| Name | Launch Date | Vehicle | Range | Mission Remarks |
|---|---|---|---|---|
| *COMSTAR-D | February 21 | Atlas Centaur | ESMC | Comsat General Corp. communications. Reimbursable. |
| *Navy 20 (NOVA 1) | May 15 | Scout | WSMC | DOD transit. Reimbursable. |
| *GOES-E | May 22 | Delta | ESMC | NOAA weather. Reimbursable. |
| *Intelsat V-B | May 23 | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |
| *NOAA-C | June 22 | Atlas-F | WSMC | NOAA weather. Reimbursable. |
| *Dynamics Explorer | August 3 | Delta | WSMC | NASA scientific. |
| *FLTSATCOM-E | August 6 | Atlas Centaur | ESMC | DOD communications. Reimbursable. |
| *SBS-B | September 24 | Delta | ESMC | SBS communicatons. Reimburseable. |
| *Solar Mesosphere Explorer | October 6 | Delta | WSMC | NASA scientific. |
| Intelsat V-C | November 19 | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |
| RCA-D | November 19 | Delta | ESMC | RCA communications. Reimbursable. |
| Navy 21 (NOVA 2) | 4th quarter | Scout | WSMC | DOD transit. Reimbursable. |

*Successful launch

## Space Shuttle Launches for 1981

| Orbiter | Launch Date | Launch Site | Payload |
|---|---|---|---|
| Columbia (OV-102) | April 12 | KSC | |
| Columbia (OV-102) | November 4 | KSC | OSTA-1 |

## Patents for Inventions from NASA Research

*The office of General Counsel, NASA Headquarters, announces that the following U.S patents have been issued by the U.S. Patent and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.*

| Inventor(s) & Employer | Title | Patent No. | Installation |
|---|---|---|---|
| Izhak Etsion and Abraham Lipshitz, Technion-Israel Institution of Technology, Haifa, Israel | Modified face seal for positive film stiffness | 4,291,887 | LeRC |
| William L. Ko, NASA/DFRC | Superplastically formed diffusion bonded metallic structure | 4,292,375 | DFRC |
| Chialin Wu and Vance C. Tyree, Caltech/JPL, Pasadena, Calif. | Real-time multiple-look synthetic aperture radar processor for spacecraft applications | 4,292,634 | NRO |
| H. Eugene Winkler, NASA/JSC | Electrophotolysis oxidation system for measurement of organic concentration in water | 4,293,522 | JSC |
| Joseph T. Baker, George W. Hoffler, and William Hursta, Technology, Inc., Houston Texas | Logic-controlled occlusive cuff system | 4,294,261 | JSC |
| David R. Fischell, Jeffrey C. Mazique, Howard University, Washington, D.C. | Cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer | 4,294,264 | GSFC |
| William S. Wang, Consolidated Controls Corp., El Segundo, Calif. | Low temperature latching solenoid | 4,295,111 | JSC |
| Milton H. Brockman, Caltech/JPL, Pasadena Calif. | Faraday rotation measurement method and apparatus | 4,295,140 | NRO/JPL |
| Robert C. Bill, Lawrence P. Ludwig NASA/LeRC | Composite seal for turbomachinery | 4,295,786 | LeRC |

# Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

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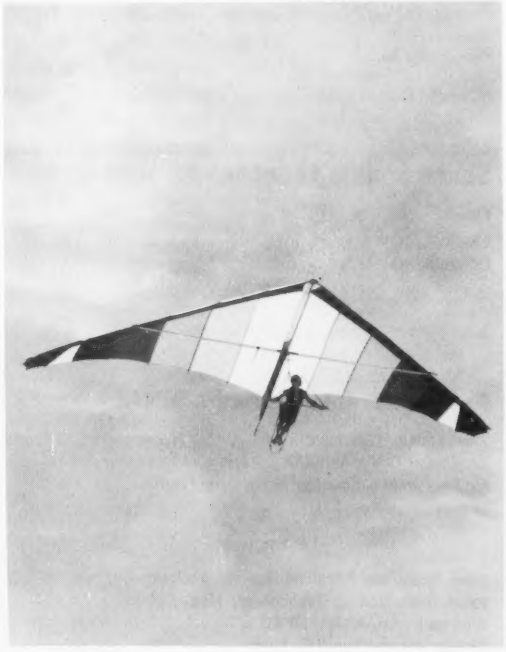
**Hang Gliders**

The hang glider pictured is built by U.S. Moyes, Inc., Bridgman, Michigan,* whose "kites" have set a number of records, including last year's world flexible wing distance record of 111 miles. The Moyes design is based in part on NASA technology developed as a once-considered alternative to parachutes for manned spacecraft post-orbital descent systems.

Hang gliders are modern versions of 19th century man-carrying kites and there have been many experimenters. Consensus holds that one of the foremost contributors to the technology was Francis M. Rogallo, a former employee of NASA and its predecessor organization, the National Advisory Committee for Aeronautics. In the latter 1940s, Rogallo and his wife Gertrude began research on flexible, controllable, fabric airfoils with a delta—V-shaped—configuration intending them for use on inexpensive private aircraft. The Rogallos were issued a flex-wing patent in 1951 and they refined their designs during the 1950s. When NASA was in the early stages of manned spacecraft development, the Rogallo wing aroused interest as a possible means of lowering a spacecraft to Earth after re-entry; its potential advantage over parachutes was the ability to glide over long distances to a controlled touchdown on land rather than in the ocean.

Ultimately, NASA decided to stick with advanced parachute descent systems—but in the interim the agency conducted extensive wind tunnel test and development of Rogallo wings and substantially broadened the flexible airfoil technology base.



*NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of such technology.

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National Aeronautics and Space Administration

For the benefit of all . . .

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